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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/628,085	GAYME ET AL.
	Examiner	Art Unit
	RONNIE MANCHO	3664

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 February 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,5-7,9-11,21,25,26,28-31,33,34 and 36-45* is/are pending in the application.

4a) Of the above claim(s) *2,21,25 and 28-30* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,5-7 and 9-1131* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Remark.

1. This is action is re-opened in view of the request submitted 2/27/08.

Specification

2. The amendment to the specification received 9/5/07 is acknowledged and entered. The amendment puts the specification back into its original filed form.

Applicant provided a dictionary definition of “residual” as a difference of compared data. The prior art teaches filtered data which is the same as residual data since in a filtering process data is compared and a difference taken, see dictionary definition provided. Also, the difference is also known as a residue according to the definitions provided.

The definitions will be adopted in prosecuting the claims.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 5-7, 9, 10, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over McBrien et al (2003/0139860) in view of Wikipedia encyclopedia (copy is labeled as “A” and attached)

Regarding claim 1, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose a fault detection system for detecting faults in a turbine engine, the fault detection system comprising:

a sensor data processor (14, 16; sec. 0050), the sensor data processor configured to receive sensor data (see QS, NP, NR, etc; sec. 0050, 0051) from the turbine engine and augment (data is filtered, conditioned, compared to thresholds, etc) the sensor data to provide an augmented data set, wherein the sensor data processor (14, 16) is configured to augment the sensor data by generating residuals (the filtered or conditioned data, etc are residuals; sec. 0050, 0051) from the sensor data and determining a rate of change of the residuals *(horse power deviation ratio. Note that the horse power is computed from the augmented i.e. conditioned sensor data; sec. 0051-0057. The HP NP DEV RAT1 is an average sum of all the horse power contribution from sensors. However, the average sum is still horse power as shown the equations in sec. 0057)*; and

a fuzzy logic inference system 30, the fuzzy logic inference system configured to receive the augmented data set (the data from units 14, 16 is passed through units 18, 20 and then to the fuzzy logic system 30; fig. 3), and wherein the fuzzy logic inference system 30 includes a plurality of membership functions, and wherein each of the plurality of membership functions is associated with at least one data type in the augmented data seta, and wherein the fuzzy logic system is configured to fuzzify the augmented data set using the plurality of membership functions and analyze the augmented data set to determine a likelihood that a fault has occurred in the turbine engine (abstract; sec. 0048, 0066-0068; when the ratio is above a or below a given number, it is determined that there is a likely hood or probability that a fault is in the engine).

McBrien teaches *rate of change* of residuals because in McBrien sensor data is sampled, filtered and converted into a horse power deviation ratio. That is Wikipedia document teaches that power is a ratio of work with respect to time. That is the rate of change of work with respect to time is power. Therefore after reading Wikipedia it would have been obvious to one of ordinary skill in the art, at the time the invention was made, that the sensor data converted to power in McBrien constitute rate of change or residual data.

Regarding claim 5, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose the system of claim 1 wherein the sensor data processor is configured to augment the sensor data by computing a margin (reference value, sec. 0051) for the sensor data.

Regarding claim 6, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose the system of claim 1 wherein the sensor data comprises engine speed data, fuel flow data and exhaust gas temperature data (sec. 0051-0054).

Regarding claim 7, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose the system of claim 1, wherein the sensor data processor is configured to receive exhaust gas temperature data and wherein the sensor data processor is configured to augment the exhaust gas temperature data by determining exhaust gas temperature margin data corresponding to a difference between the exhaust gas temperature data and a maximum safe temperature.

Regarding claim 9, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose the system of claim 1 wherein the fuzzy logic inference system includes a plurality of rules, and wherein the fuzzy logic system is configured to evaluate the fuzzified augmented data set according to the plurality of rules.

Regarding claim 10, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose the system of claim 9 wherein the fuzzy logic inference system is further configured to aggregate outputs of the plurality of rules and defuzzifies the aggregated output for input into a diagnostic system.

Regarding claim 11, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose the system of claim 10 wherein the aircraft system comprises a turbine engine and the sensor data, exhaust gas temperature data, engine speed data, and fuel flow data (sec. 0051-0054), and wherein the sensor data processor is configured to augment the sensor data by generating residuals from the exhaust gas temperature data, engine speed data and fuel flow data (sec. 0051-0054), and wherein the sensor data processor is configured to further augment the sensor data by determining a rate of change of the residuals (see claim 1), and wherein the sensor data processor is configured further to augment the sensor data by determining a margin (reference value, sec. 0051) for the exhaust temperature data corresponding to a difference between the exhaust gas temperature data and a maximum safe exhaust gas temperature for the turbine engine.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claim 31, 33, 34, 36-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over McBrien et al (20030139860) in view of Martucci et al (6289274) and further in view of Wikipedia document.

Regarding claim 31, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose an apparatus comprising:

a processor (14, 16; sec. 0050);

a fault detection program executed by the processor (14, 16; abstract, sec. 0050-0054).

McBrien et al disclose programs, but does not disclose a memory storing the programs. However, Martucci et al teach of a memory coupled to a processor, wherein the memory comprises a fault detection program residing in the memory and being executed by a processor (14; col. 4, lines 60 to col. 5, line2). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify McBrien for the purpose of storing executable fuzzy programs on a memory;

Thus, McBrien as modified by Matucci et al disclose the fault detection program including:

a sensor data processing program (sec. 0050-0054, McBrien), the sensor data processing program configured to receive sensor data (see QS, NP, NR, etc; sec. 0050, 0051, McBrien) from the turbine engine and augment (data is filtered, conditioned, compared to thresholds, etc) the sensor data to provide an augmented data set, wherein the sensor data processing program is configured to augment the sensor data by generating residuals (the filtered or conditioned data, etc are residuals; sec. 0050, 0051, McBrien) from the sensor data and determining a rate of change of the residuals (horse power deviation rate. Note that the horse power is computed from the augmented i.e. conditioned sensor data; sec. 0051-0057. The horse power rate of change for each sensor is provided respectively in the equations in sec. 0057, McBrien); and

a fuzzy logic inference program 30, the fuzzy logic inference system configured to receive the augmented data set (the data from units 14, 16 is passed through units 18, 20 and then to the fuzzy logic system 30; fig. 3; McBrien), and wherein the fuzzy logic inference system 30 includes a plurality of membership functions, and wherein each of the plurality of membership functions is associated with at least one data type in the augmented data seta, and wherein the fuzzy logic program is configured to fuzzify the augmented data set using the plurality of membership functions and analyze the augmented data set to determine a likelihood that a fault has occurred (abstract; sec. 0048, 0066-0068; when the ratio is above a or below a given number, it is determined that there is a likely hood or probability that a fault is in the engine; McBrien).

McBrien in view of Matucci teach *rate of change* of residuals because in McBrien sensor data is sampled, filtered and converted into a horse power deviation ratio. That is Wikipedia document teaches that power is a ratio of work with respect to time. That is the rate of change of work with respect to time is power. Therefore after reading Wikipedia it would have been obvious to one of ordinary skill in the art, at the time the invention was made, that the sensor data converted to power in McBrien constitute rate of change or residual data.

Regarding claim 33, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose the apparatus of claim 31 wherein the sensor data comprises engine speed data, fuel flow data and exhaust gas temperature data (sec. 0050-0054).

Regarding claim 34, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose the apparatus of claim 31 wherein the sensor data processing program is configured to receive exhaust gas temperature data and wherein the sensor data processing program is further configured to augment the exhaust gas temperature data by determining exhaust gas temperature

margin data corresponding to a difference between the exhaust gas temperature data and a selected maximum safe exhaust gas temperature for the turbine engine.

Regarding claim 36, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose the apparatus of claim 31 wherein the fuzzy logic inference program includes a plurality of rules, and wherein the logic system is configured to evaluate the fuzzifed augmented data set according to the plurality of rules.

Regarding claim 37, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose the apparatus of claim 36 wherein the fuzzy logic inference program is configured to further aggregate outputs of the plurality of rules and defuzzify the aggregated output for input into a diagnostic system.

Regarding claims 38 McBrien et al (abstract, figs. 1, 3-7; pages 2-5) disclose the apparatus of claim 31, wherein the sensor data comprising exhaust gas temperature data, engine speed data, and fuel flow data, and wherein the sensor data processing program is configured to augment the sensor data by generating residuals from the exhaust gas temperature data, engine speed data, and fuel flow data (sec. 0050-0054), and wherein the sensor data processing program is configured to further augment the sensor data by determining a rate of change of the residuals (see claim 31), and wherein the sensor data processing program is configured to further augment the sensor data by determining a margin for the exhaust gas temperature data corresponding to a difference between the exhaust gas temperature data and a maximum safe exhaust gas temperature for the turbine engine.

7. Claims 39-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over McBrien et al (20030139860) in view of Brown et al (5377112).

Regarding claim 39, McBrien et al (abstract, figs. 1, 3-7; pages 2-5) a fault detection system for detecting faults in a turbine engine, the fault detection system comprising:

a sensor data processor (14, 16; abstract, sec. 0050-0054) the sensor data processor configured to:

receive sensor data from the turbine engine (see QS, NP, NR, etc; sec. 0050, 0051);

determine a rate of change of sensor data residuals (the filtered or conditioned data, etc are residuals; sec. 0050, 0051); and

a fuzzy logic inference system 30, the fuzzy logic inference system configured to receive the sensor data residuals (the data from units 14, 16 is passed through units 18, 20 and then to the fuzzy logic system 30; fig. 3), and wherein the fuzzy logic inference system 30 includes a plurality of membership functions, and wherein the fuzzy logic system is configured to fuzzify the sensor data residuals using the plurality of membership functions to determine a likelihood that a fault has occurred in the turbine engine (abstract; sec. 0048, 0066-0068; when the ratio is above a or below a given number, it is determined that there is a likely hood or probability that a fault is in the engine).

Although McBrien disclose sensing engine data, they did not particularly disclose exhaust gas temperature data, engine speed data, and fuel flow data. However, Brown et al teach of a turbine engine wherein a sensor data processor (202, col. 3, lines 42-56; figs 1, 2) the sensor data processor configured to"

receive sensor data from the turbine engine the sensor data including exhaust gas temperature data, engine speed data, and fuel flow data (202, col. 3, lines 42-56; col. 9, lines 8-11; figs 1, 2).

generate exhaust gas temperature residuals (implies comparing and taking a difference) by comparing the exhaust gas temperature data to expected values of exhaust gas temperature (abstract, col. 3, lines 42-56)

generate engine speed residuals (implies comparing and taking a difference) by comparing the engine speed data to expected values of engine speed (abstract, col. 3, lines 42-56);

generate fuel flow residuals (implies comparing and taking a difference) by comparing the fuel flow data to expected values of fuel flow (col. 9, lines 8-11; figs 1, 2).

Thus Mcbrien as modified by Brown et al disclose a sensor data processor configured to:

determine a rate of change of the exhaust gas temperature residuals;

determine a rate of change of the engine speed residuals;

determine a rate of change of the fuel flow residuals; and

a fuzzy logic inference system, the fuzzy logic inference system configured to receive the exhaust gas temperature residuals, the engine speed residuals, the fuel flow residuals, the rate of change of the exhaust gas temperature, re residuals, the rate o1' change of the engine speed residuals, and the rate of change of the fuel flow residuals, and wherein the fuzzy logic inference system includes a plurality of membership functions, and wherein the fuzzy logic system is configured to fuzzify the exhaust gas temperature residuals, the engine speed residuals, the fuel flow residuals, the rate of change of the exhaust gas temperature residuals, the rate of change of the engine speed residuals, and the rate of change of the fuel flow residuals using the plurality o f

membership functions to determine a likelihood that a fault has occurred in the turbine engine.

Regarding claim 40, McBrien et al (abstract, figs. 1, 3-7; pages 2-5)/Brown et al disclose the system of claim 39 wherein the plurality of membership functions include a low membership function, a medium membership function and a high membership function (see fig. 5, McBrien).

Regarding claim 41, McBrien et al (abstract, figs. 1, 3-7; pages 2-5)/Brown et al disclose the system of claim 40 wherein the low membership function comprises a first sigmoid function, and wherein the medium membership function comprises a trapezoid function, and wherein the high membership function comprises a second sigmoid function.

Regarding claim 42, McBrien et al (abstract, figs. 1, 3-7; pages 2-5)/Brown et al disclose the system of claim 40 wherein the fuzzy logic inference system is configured to fuzzily the exhaust gas temperature residuals, the engine speed residuals, the fuel flow residuals, the rate of change of the exhaust gas temperature residuals, the rate of change of the engine speed residuals and the rate of change of the fuel flow residuals using the plurality of membership functions by generating an aggregated output function from the plurality of membership functions (MCBrien, fig. 5).

Regarding claim 43, McBrien et al (abstract, figs. 1, 3-7; pages 2-5)/Brown et al disclose the system of claim 42 wherein the fuzzy logic inference system is configured to determine a likelihood that a fault has occurred in the turbine engine by determining a centroid of area under the aggregated output function (MCBrien, fig. 5).

Regarding claim 44, McBrien et al (abstract, figs. 1, 3-7; pages 2-5)/Brown et al disclose the system of claim 43 wherein the fault comprises a high pressure spool fault.

Regarding claim 45, McBrien et al (abstract, figs. 1, 3-7; pages 2-5)/Brown et al disclose the system of claim 39 wherein the sensor data processor is configured to determine the rate of change of the exhaust gas temperature residuals using a linear fit of the exhaust gas temperature residuals, and wherein the sensor data processor is configured to determine the rate of change of the engine speed residuals using a linear fit of the engine speed residuals, and wherein the sensor data processor is configured to determine the rate of change of the fuel flow residuals using a lineal fit of the fuel flow residuals (see fig Brown, figs. 8-12).

Response to Arguments

8. Applicant's arguments filed 2/27/08 have been fully considered but they are all not persuasive.

All 112 rejections have been withdrawn.

All 102 rejections have been withdrawn.

Applicant argues that McBrien does not teach calculation of residuals, particularly that the filtering and conditioning of sensor data in McBrien is not calculation of residuals. The examiner disagrees. Residuals refers to a difference between data observed and expected values See Wikipedia documents labeled “B”. McBrien teaches a deviation in data observed. A deviation is also known as a difference between observed data. See Wikipedia document labled “C”. Applicant’s dictionary definition submitted 9/5/2007 in the remarks admits that residuals constitute a difference.

Therefore, the prior art anticipate the claims.

Applicant further argues that the prior art McBrien et al do not disclose “deviation rate”, but instead disclose “deviation ratio”. The examiner disagrees and refers applicant to the dictionary definition submitted by the examiner. The definition indicates that "rate” and “ratio” are the same. Therefore, “deviation ratio" and “deviation rate” are the same. McBrien also shows that the sensor data are mapped as seen in units 45 fig. 5. The graphs therein show a slope, thus a rate of change. It is further noted that the bar chart of fig. 2 shows rate of change of data across the board. It is further noted that McBrien section 0059 analyses deviation ratios of sensor and determines which has the largest deviation, thus a rate of change of sensor data is determined. As already mentioned above and admitted by applicant, “residuals” refers to a difference in compared data. McBrien disclose comparing engine sensed data to a mean thus determining “residuals” as defined by applicant. McBrien also discloses filtering which meets applicant's definition of “residuals” since data is compared and a difference taken in a filtering process. McBrien’s filtered data are mapped and a slope therefor shown, thus disclosing a rate of change of sensor data residuals. As already mentioned, McBrien discloses deviation ratio which means deviation rate.

McBrien teaches *rate of change* of residuals because in McBrien sensor data is sampled, filtered and converted into a horse power deviation ratio. That is Wikipedia document teaches that power is a ratio of work with respect to time. That is the rate of change of work with respect to time is power. Therefore after reading Wikipedia it would have been obvious to one of ordinary skill in the art, at the time the invention was made, that the sensor data converted to power in McBrien constitute rate of change or residual data.

Applicant further argues that McBrien does not disclose a fuzzy logic inference system because McBrien discloses "fuzzy logic calculations" which perform calculations relating to bypass, stopping, or enabling the fault detection system. The examiner disagrees and notes that applicant is reading limitations from the specification into the claims. This is improper. As admitted by applicant, McBrien discloses a fuzzy logic system. Applicant particularly argues that McBrien does not disclose “membership functions” in the fuzzy logic system. The examiner disagrees and notes that unit 30 of fig. 3 is a fuzzy logic system. Unit 30 if further defined in fig. 4 to show membership functions which refer to the different units (34, 34, 36, the boxes with the mathematical symbols, etc) that make up the fuzzy logic system. As already noted, McBrien determine faults in a turbine engine. Thus McBrien disclose a likelihood that a fault has occurred. McBrien further uses a fuzzy logic inference system including membership functions as already explained. Thus McBrien discloses the claimed limitation.

Applicant further argues generally that the combination of McBrien and Matucci is improper, but does not point out why the combination is improper as a 103 (a) rejection.

Applicant further argues generally that the combination of McBrien and Brown is improper, but does not point out why the combination is improper as a 103 (a) rejection.

The examiner believes that the 103 rejections are proper for reasons provided above. The rejections thus stand.

Communication

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to RONNIE MANCHO whose telephone number is (571)272-6984. The examiner can normally be reached on Mon-Thurs: 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tran Khoi can be reached on 571-272-6919. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Ronnie Mancho
Examiner
Art Unit 3664

6/22/2008
/Khoi H Tran/
Supervisory Patent Examiner, Art Unit 3664